The Science Teacher

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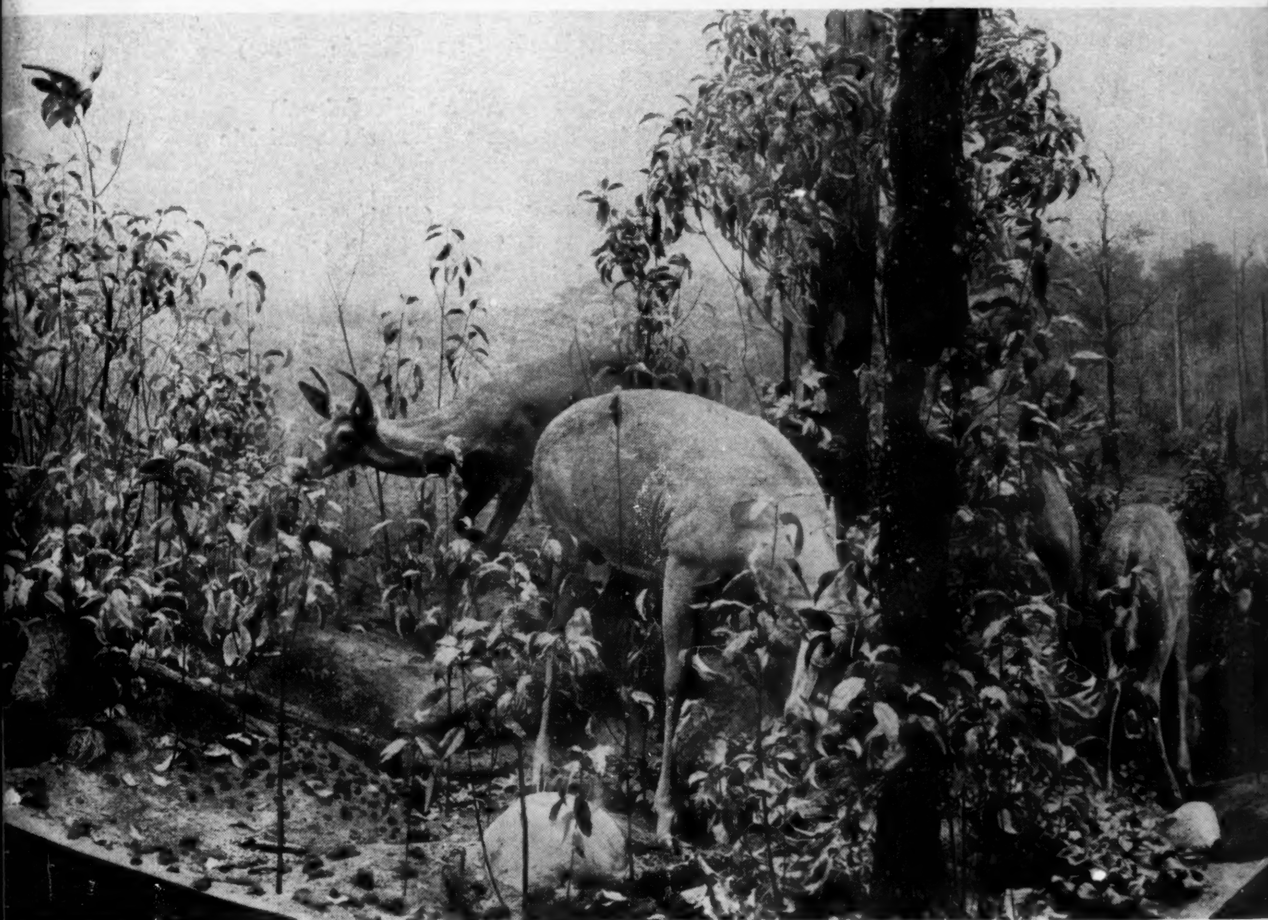

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Including

THE ILLINOIS CHEMISTRY TEACHER

VOLUME V | FEBRUARY, 1938 | NUMBER 1

Training the Biology Teacher

MARY STEAGALL

Southern Illinois State Teachers College — Carbondale, Illinois

The subject of this theme more exactly expressed says: "Scientific training for the science teacher".

If to do, were as easy as to know what it were good to do, chapels had been churches; poor men's cottages, princes' palaces; and—perhaps—Normal college teachers, university professors:

So with teaching: "I can easier teach twenty what were good to be done, than to be one of the twenty to follow mine own teaching".

In our section of Illinois, and this may be approximately true throughout the state, pupils enter high school because it is a century-old custom to do so, and because they look forward to it as their privilege and right.

Their aims and voluntary activities are aesthetic, recreational, and social. These accomplishments are usually quite divorced from the high school curriculum and must be confined to evenings, holidays, and week ends.

Also high school children come from primary schools where they either subconsciously did the work outlined by their teachers, or found themselves compelled to do it by whatever legal right the community allows the school authorities to employ for directing student activities. The latter is much too frequent.

This general attitude quite naturally is carried over into their secondary school activities. They endure the six hours per day of high school work, looking forward to the social activities of afternoon and evening. Very few lug home books with the intention of devoting the evening to them. A thirst for knowledge or a desire for skill in the early teens is very unusual.

Consequently, freshmen classes in all liberal colleges are filled with young people, a small part being a flotsam on college life, but most attempting to get their bearing and to decide to what occupation they are to look forward for a livelihood. This results in a tentative, uncertain attitude toward their college subjects.

Those entering our teachers colleges usually expect to teach, but look forward to it not as a profession but rather as a stepping stone to some unknown, more desirable, and more lucrative position.

A very small per cent of those entering our teachers colleges look forward to teaching as a profession; probably as small a portion as of those entering our universities. This is especially true at Carbondale, which stands as the college without competition in that area, and a school where those of moderate means are able to enter into any of the social and scholastic activities of which he shows himself worthy. A state teachers college, like the State University, belongs to the student and to his parents. They know it and come claiming their heritage. We acknowledge that and recognize their property and their rights. I speak now for all our state colleges:

Through a well thought out and concerted arrangement we offer in the first two years a general culture course with definite requirements in social studies, humanities, biological and earth science, physical science and mathematics, practical arts and crafts, and in physical education, recreational activity.

During these two years, under skillful teachers and helpful advisers, the students are encouraged to choose the lines in which they show greatest aptitude.

If after practically two years of general culture with an exposure to psychology they maintain their desire to teach, the first step in scientific procedure is to choose a field of work. It is usually at this point that we come to know who are to be teachers in biology. Here the scientific training for a science teacher begins.

During his two years of general college work, the prospective secondary teacher has made his decision of major subjects and has usually begun work on allied subjects, optionals and minors. These latter subjects make his background of material and furnish the relief for his major.

Should the chosen subject be one from the biological or earth science group: Botany, Zoology, Physiology, or Geography, he chooses one as a major, one or two others as minors, and the others for a unit of work.

In his major, in addition to the general courses taken during the cultural training, he then selects a certain amount of field work, detailed laboratory courses, technique courses for instruction in preparation of class materials, and studies taxonomic methods of determining classification.

These courses cause him to feel at home in his subject and furnish him with fundamental teaching knowledge.

The allied courses which we would suggest are: fundamentals of physics, chemistry, physiography, astronomy, geology, and foreign language—preferably French if Latin was taken in high school; German is also desirable. These allied subjects are the walls around his citadel, without which his weakness as a teacher is a foregone conclusion. With these he maintains his citadel, interesting, attractive, admirable.

Required courses in psychology, sociology, education, and method open his eyes to the reaction of the mind in its teens; his reflective memory of high school days cause him to see that the ancient secondary method of divorcing studies and social activities and pitting them against each other was unpedagogic and decidedly artificial.

The study of biological science with its indoor social work-shop and broad outdoor attractive laboratory shows him the possibilities of harmonizing study with recreational activity. So he learns to organize bird study groups, camera clubs, hiking parties through forests, fields, and streams, Nature study classes where the one who recognizes the greatest number of birds, beasts, brush, or stones carries off the honors of the day. He sees that interest in real living things outside the laboratory furnishes an incentive for motivating students, a motive difficult to secure in many other subjects.

His pupils will learn the thrilling value of a walk through the forest and along the stream with someone who can authoritatively say that the insect holding his gauzy wings outstretched parallel to the plant on which he rests is a dragonfly, the smaller sister holding its pastel colored gauzy wings vertical to its body is the damsel fly, and that both spend their lives in ridding lowlands, ponds, and streams of gnats, mosquitos, and midge-flies. They respect one who sees the ravenous tiger beetle hiding beneath the stone watching for its prey, and knows that the fisherman would gloat to find and serve up this same tiger as a bait for his fish. What excitement they experience as they help him discover the homely little toad bugs leaping from their holes along the stream to catch insects in regular toad-like style.

What an exquisite sensation when first they realize how the pines and hard maples carry their main trunks to their

tips, while the soft maples, American elms, and lindens deliquesce into limbs from the lowest branches. Hence the biology teacher, dealing with living protoplasm stirs the quivering nerve of response in the student intellect, thus motivating the work of the high school student with interest until he trembles with anticipation for further scientific investigation.

Living things have a strong appeal, and outdoor life invigorates. Through these, young people come into a normal love of country and a feeling for their own locality based on non eradicable principles.

How stimulating to a teacher to apperceive that high school people are but waiting for someone to awaken them to the opportunities of discovery. Biology offers thousands of such possibilities.

Unless the secondary teacher furnishes this appeal to graduating high school students, they enter college, if at all, as a habit or fad, wasting weary weeks, months, perhaps years, before orienting themselves to something worth while.

Those individuals who are awake to the subject they like and have capacity along that line are the ones who of late have broken the iron rules of the North Central Association and demanded that the colleges exempt them by entrance examinations from the often meaningless routine and admit them to courses they wish and are prepared to take. They demand that education be direct and purposeful, not aimless nor at random.

Such students have little need of outlined college courses and teachers. Their wants lie in opportunity, laboratories, and libraries. They become masters in their chosen fields regardless of discouragements.

It is the uncertain unoriented wavering soul who awaits a teacher to sell him his subject, and in addition show him the way through its mazes.

The appropriate training of a teacher is not achieved until he has developed a technique which will enable him to plan subject matter units, to assemble suitable illustrative material, and to discover how to fit this material into the daily teaching program, whether lecture or laboratory, or a combination of the two. In other words, he needs practice under supervision, which is given in a training school. This is best given after at least a minor in the subject has been taken.

Only last week our football captain, used to all sorts of rough and tumble, give-and-take, came out of a half hour's grilling by the high school class to which he was assigned, shaking his head saying, "You certainly have to know something about a subject when you attempt to teach it". He had successfully awakened their interest in the subject of reptiles; but when they pinned him down with all sorts of questions he had to fence, parry, then side-step so many questions that he came out more excited and red-faced than he did from the football game he had just played against Macomb. In reality, I believe he actually enjoyed the class more than the ball game.

Dicken's Dotheboy's Hall philosophy, "Learn to do by doing," unquestionably applies to teaching. The young teacher, with the right attitude toward his subject, has his best opportunity to learn the technique of teaching, in the institution in which he learned his subject, under the direction of his teacher of that subject, with the library, laboratory equipment, and outdoor projects at hand with which he is familiar.

Young people of high school age are fun loving, wide awake to the world, measuring their deeds, valuables, and acquaintances by their own ideals of what contributes to a joyous, self-centered life. The real work of the biology teacher is to get this eccentric whirl of the high school pupil into the swing of the universe. To lead the self-centered individuals to a knowledge of the fact that ions of hydrogen, oxygen, carbon, nitrogen, plus an irregular sprinkling of mineral atoms, and perhaps a few other

(Continued on page 18)

THE SCIENCE TEACHER

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And Serving
The Illinois Biology Teachers' Association
The Indiana High School Chemistry Teachers' Association
And Other Science Associations

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Normal Community High School, Normal, Illinois
P. K. Houdek ---------- Assistant Editor
Robinson Township High School, Robinson, Illinois
W. Glen Tilbury ---------- Advertising Manager
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ASSOCIATION MEETINGS

The preliminary program of the Spring Meeting of the Illinois Association of Chemistry Teachers appears quite promising. (See Page 12). The Field Trips bring first hand contact with practical applied chemistry and research in a new commercial field. The luncheon not only brings the usual fellowship that no one wants to miss but also "mental meat" to digest. The afternoon program offers new material to enrich the chemistry course, up-to-the-minute theory, teaching helps, and consideration of a perplexing teaching problem. What more would anyone want in one day's program. Illinois chemistry teachers should begin planning at once for this worthwhile event.

Professor W. E. Harnish of the Education Department of the University of Illinois is in charge of the local arrangements and is largely responsible for the program. Both he and Dr. George C. Ashman, President of the Association are to be complimented for the excellent program provided.

Indiana:

A very interesting and helpful program is in prospect for the High School Chemistry Teachers Association of Indiana at its meeting at Indiana State Teachers College in Terre Haute, Indiana, April 15 and 16, 1938. The officers under the leadership of Mr. Edward Zetterberg of Muncie High School, President of the Association, are arranging a program featuring "Teacher eDmonstration Experiments to Illustrate Chemical Experiments". This should prove very popular as science teachers are ever on the alert for good demonstrations for their classes. The program will extend over both Friday ad Saturday.

Friday morning, April 15, will probably be given over to visiting the four high schools in Terre Haute and the Rose Polytechnic Institute. A field trip through the extensive chemical plant of the Commercial Solvents Corporation has been arranged for Saturday.

Friday evening a dinner is to be given in honor of Professor Bruce, retired professor of chemistry of Indiana State Teachers College. (See page 12).

An exhibit of work done, of things made, by high school students from the schools represented by members of the Association is to be a feature of the meeting.

Science Projects and Junior Academies

EDITORIAL COMMENT

Now that science projects for the high school student are becoming increasingly prominent through the activities of State Junior Acadamies of Science it may be well to inquire into their nature, their value in relation to class work and extra-curricular activities, and to note some of the common practices in using them. Especially is consideration due so as to prevent the misuse and discrediting of a valuable teaching tool by those who have the wrong conception of it and of its place in the curriculum.

The usual science project involves activities that appeals to the interest of the student and is definitely related to the world about him. In it science takes on meaning in relation to life. The project, for example, may be making paper, constructing a working model of a water softening plant, or growing plants or animals under controlled conditions. But whatever it is, it presents a vital situation out of which may grow understanding and appreciations and through which practice may be had in real scientific thinking.

To assume that a project should be the challenging situation about which a whole unit of work is to be built is going to the extreme. Sometimes this may be done, especially by a skillful teacher. Usually, however, projects are not wide enough in scope to include all that is wanted in a unit of work. So it appears that projects are best used to supplement the unit being studied and to provide activity both physical and mental that lead to the attainment of the objectives set by the instructor.

As to how much actual value the project has will depend upon the skill of the teacher just as is true with individual laboratory work or demonstrations . The superior teacher will see in it a challenging situation leading to thinking in terms of scientific facts and principles and providing the opportunity to drive home principles that already may be under consideration. He will find in it an opportunity to work with the backward student and to stimulate his efforts by seeing that he has work which he can successfully perform and which he will enjoy. He will find in it the chance to win the friendship and willing cooperation of those few perverse individuals that at sometime are inflicted on every teacher. In fact he will find in it the natural situation in which psychology may be successfully applied to problem cases. In fact he will find in the project a useful tool of value in many ways.

For the science club, projects offer an activity that stimulates interest which is so essential to building up a live and aggressive club. They result in exhibits, in concrete evidence to club members, to their fellow students, and to the public that the club is accomplishing something worthwhile. They offer a means by which students may learn to work together, learn cooperation, and gain closer acquaintanceships. They bring personal satisfactions and pleasures which should be associated with the field of science as well as with the less appealing affairs of the world about us.

As to the time of doing project work many teachers report that they require it done outside of the regular teaching periods, before and after school hours at school and also at the student's homes. However, the time given to project work must be worked out with due regard to the local situation. It is doubtful if very much if any of the regular class hour should be used for this purpos.

A question often raised is whether every student should participate in project work. Here again teaching practice varies widely. Some teachers require every student to take part in this work in addition to the regular schedule. Many, however, prefer to allow only students interested in projects to choose them. Then the student is guided in

his choice so that he may attempt something within the scope of his ability and with which he may succeed.

Project work has become so popular with both students and teachers, not merely as a fad, but as an activity of educational worth that State groups of science teachers are sponscring exhibits and State contests of science project wor. In fact the work is taking on National significance and is given recognition in journals such as the Science Leaflet. Among the States found doing work in this field are Illinois, Indiana, Iowa, Kansas, Kentucky, Nebraska, Pennsylvania, and Texas. In Illinois an exhibit of projects will be a regular part as usual of the Illinois Junior Academy of Science program at its meeting at Carbondale May 6. The exhibits of student projects at the meeting of the academy have become particularly noted not only for quantity but also got the superior quality of the work. It appears that work of this type is deserving the loyal support of the teachers of every State.

—John C. Chiddix.

MEETING OF THE AMERICAN SCIENCE TEACHERS ASSN.

The recent meeting of the American Science Teachers Association was one of the high lights of science meetings held recently in Indianapolis in conjunction with the A. A. A. S. The morning program of December 30 as arranged by Professor Earl R. Glenn, of State Teachers College of Montclair, New Jersey, was unique in bringing together three outstanding men, Professor Harold Urey of Columbia University, Professor Arthur Compton of the University of Chicago, and Dr. W. M. Stanley of the Rockefeller Institute for Medical Research. The first two have received the Nobel award and the third has received the $1000 prize for outstanding achievement i nhis work with tobacco virus. If space permitted it would be interesting to give a brief review of the papers presented by each.

Dr. Urey spoke of his work with heavy water, heavy hydrogen and heavy oxygen and pointed to the possibilities ahead for its use as a research tool in many fields. It was fascinating to the unitiated to be let in on some of the sidelights as to the trials and tribulations of a scientist in building and keeping in operation apparatus sensitive enough to detect one part in a million of an element such as heavy hydrogen. Moreover it was a little staggering to learn in connection with the concentration of heavy water as found in ordinary water that if the usual process of distillation is used to produce 100 cc of the product, a mass of 10^{273} grams of water would have to be distilled. When we note the mass of the nuiverse is only 10^{53}, we see the impossibility of ordinary procedures. However by an adaption of the distilling process it is now possible to produce 100 cc of water daily in which the concentration of heavy water has been raised from .001944 parts as found in normal water to 008604. Steam from the water that is being concentrated is condensed by a returning stream of water in which more of the heavy water molecules condense than the lighter ones. The result is an increasing concentration of heavy water .

Dr. Urey discussed the activity of heavy hydrogen and heavy oxygen in replacing the normal form in compounds and its uses when so substituted. Heavy hydrogen has proved to be the more active as would be expected. It is readily substituted in the methyl groups in compounds including glycerol and urea show no reaction with heavy oxygen. The interchange in the case of tri-chloracetic acid is quite rapid, too rapid to study its mechanism. With acetaldehyde it proved to be more moderate while with the acetone the reaction proceded slowly. Dr. Urey stated that the later was then chosen for special study and that the reaction was found to be catalyzed particularly by hydroxyl ions.

It was pointed out that the heavy atoms of isotopes such as heavy hydrogen and oxygen provide a means by which chemical reactions may be followed as the heavy atoms provide a marker that can be accurately checked. Also

it provides medical research a tool by which the work of drugs in the body can be traced. Thus the use of heavy isotopes of elements made possible by present methods of producing them and detecting their presence has opened up a new era in the field of science just as has the x-ray in the past.

REPORT OF THE FIFTH ANNUAL MEETING OF THE AMERICAN SCIENCE TEACHERS ASSN.

A SUMMARY

With this meeting the organization of the American Science Teachers Association, initiated in Boston, December, 1933, was completed The Board of Directors representing the members at large and the thirteen charter affiliated organizations of science teachers held a dinner meeting and conference Wednes day evening, December 29. These representatives and others elected at previous meetings were from seven different states. The public meeting of the Association held on Thursday, December 29, aws attended by approximately 250 teachers from 25 states and 70 cities. These data are mentioned to indicate the country-wide interest in the American Science Teacher Association.

At the directors' meeting, representatives of the different organizations made brief reports disclosing among other things that the affiliated membership now totals upward of 3000 members. Moreover, the affiliated organizations represent many of the strongest and largest science teachers' associations in the country. Applications have been received for affiliation from other organizations, and it is expected that these will increase considerably during the coming year. Every science teachers' organization in the country is invited to write for information regarding affiliation.

It was also brought out that enrollment in science in high schools appears to be decreasing. Laboratory instruction is decreasing, and there is a felt need of devising ways and means of bringing more forcibly to the attention of principals and superintendents than at present the important place that science education has and must continue to have in American education.

The program held Thursday forenoon and presided over by Dr. Earl R. Glenn, State Teachers College, Montclair, New Jersey, was an outstanding event in the history of all science teachers' meetings. Two of the speakers were Nobel prize winners. The third speaker was a year ago awarded the $1000 prize for research relating to the cause of the tobacco mosaic disease.

The symposium under discussion, "New Knowledge of Matter," was developed under the following titles:

"Properties of the Isotopes of oxygen," Dr. Harold C. Urey, Columbia University.

"Some Physical and Biological Consequences of the Discovery of X-rays," Dr. Arthur H. Compton, University of Chicago.

"Recent Discoveries Concerning the Virus Diseases," Dr. W. M. Stanley, Rockefeller Institute for Medical Research, Princeton. N. J.

The luncheon meeting presided over by Dr. Otis W. Caldwell, General Secretary for the American Association for the Advancement of Science, was addressed by Dr. George D. Birkhoff, President of the American Association for the Advancement of Science. His topic was "Present Status of Aesthetic Measure." It was a rare treat for the science teachers to listen to a mathematician of note bringing aesthetic things into the realm of measurement.

The afternoon session, Thursday, December 30, was presided over by Harry A. Carpenter, Specialist in Science, Rochester Schools, Rochester, New York. The symposium topic discussed was "The Need for a Twelve-Year Science Program for American Public Schools. Dr. Ralph K. Watkins, University of Missouri, discussed the topic "From the Viewpoint of a State University and its Laboratory Schools." Miss Mary Melrose, Supervisor of Elementary Science in the Cleveland Public Schools, Cleveland, Ohio, presented "The Viewpoint of Experimental Schools in City Systems." Dr. W. C. Croxton, State Teachers Col-

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Chemistry for Non-College Preparatory Students

R. R. BUELL

Beaver Dam High School Beaver Dam, Wisconsin

The past few years have witnessed a great increase in the enrollment in secondary schools and the crowding of the already inadequate facilities of many schools. Three years ago our own system placed its four year high school on a requirement basis that further taxed the available facilities, a four year requirement in each of the divisions of science, social science, and English From the standpoint of educating pupils for life this seemed an advantageous swing away from the all-elective systems which have grown up in some places. However, it overloaded the science department with larger classes and more of them. Moreover, the laboratory which had formerly been overcrowded even with smaller classes became an almost impossibility. The problem of what to do and how to do it had to be met squarely.

In chemistry, almost more than any thing else, the laboratory question was a big one, since it required more extensive equipment set-ups as far as individual work was concerned. A happy solution seemed to be the discarding of the time-worn boiled-down college course (considering that only about 10 per cent of our students were actually to go to college) and the adaption of the more everyday aspects of chemistry. Chemistry must be taught so as to explain life situations.

For the college preparatory students the standard chemistry course was offered, from the laws of physical science to radio-activity; but for the non-college preparatory group a new course of study was evolved. More recent revisions have grouped it under two psychological heads, rather than several logical ones: Science and Man, and Chemistry in Industry. Under the former are taken up such topics as: the chemistry of digestion and nutrition; the cheimstry or respiration; the chemistry behind our clothing; how our minds work; the drugs, poisons, and cosmetics problem; the diseases which affect man, and their treatment; and how we inherit. During the discussion of Chemistry in Industry the class investigates about fifteen industries which make the United States prominent, and the chemistry behind them. Student demonstration replace individual laboratory.

The philosophy of such a course of study I believe to be sound. Chemistry should be taught with its basis in the nature of the mind and in the nature of human nature. Since, in the history of man's knowledge, he has followed the psychological approach, it is foolish to lead him by the logical, for the latter is only logical when a feasible theory has been worked out with and from all the facts in hand. The discovery of these facts, however, and the thinking on the original problem followed the psychological apporach of all human endeavor —trial and error. Although the steps are too complex to be analyzed, nevertheless the psychological undoubtedly preceded the logical.

One decided advantage of this system is to be noted. Practicality is the rule. When a common element is taken up in the college preparatory course, for example, we discuss its qualities under about six usual heads: occurrence, historical, preparation, properties (both physical and chemical) and uses. In this method the preparation (on a com mercial scale) is stressed without equations, if possible, and its uses as they affect everyday living are made predominant. Radium is not of interest because of its properties, but because of its properties, but because of its functions and uses in cancer treatment. Water is taken up as it effects man's body, and from that point research is begun into its composition, purification, and peculiarities. A psychological approach to each item is obtained, with irrelevant items suppressed except for individual research where interest is shown.

Photography by Infra-Red and Ultra-Violet Radiation

HERBERT JOHNSON

Eastman Kodak Company Rochester, New York

It has long been known that the waves of light emitted from sources are not confined to those that are visible. Waves of shorter length than 400 millimicrons are detectable by photography, and these are known as "ultra-violet" waves, while waves longer than 700 millimicrons can be dectected by their heating effect and are known as "infra-red" waves. The ultra-violet spectrum extends through a great range of wave-lengths until finally the ultra-violet rays are short enough to be identical with the x-rays, discovered by Roentgen, and similarly the infra-red waves get longer without limit and merge into electrical waves which are used in radio transmission.

The principal use of infra-red rays in photography is for the penetration of haze in landscape work. When distant landscapes are photographed on non color sensitive plates or films, the distance always appears hazy, and a very slight amount of mist will result in the complete absence of detail in the distance. The reason is that the suspended particles of water vapor, which are transparent for the longer waves of light and, therefore, only affect vision slightly, act as very turbid medium for the deep violet and ultra-violet waves, scattering them, and producing on the plates much the effect that would be seen if one were to try and look through a sheet of finely ground glass. As the water vapor condenses, its selection of the longer wave-lengths increases; a fog, for distance, will absorb the blue and green rays from the light of an arc lamp but will permit the red to pass in greater measures, so that at a little distance the lamp will appear red. It is for this reason that the sun appears red when viewed through a mist or fog. The scattering effect of mist near the ground is at a maximum in the ultra-violet and decreases as we pass towards the red. In addition, when the sky is blue, the mist reflects this light and appears blue from that cause.

This scattering by mist can be removed by the use of filters which absorb the scattered ultra-violet and violet light, and the removal of the scattering will increase progressively as deeper and deeper filters are used, so that a strong yellow filter will involve a loss of "atmosphere" in the picture as compared with the visual appearance. For pictorial landscape photography, therefore, it is necessary that sharp cut, strong filters should be avoided. In telephoto and aerial work, however, the mist intervening in the great aerial distances between the lens and the object to be photographed is a very serious and real difficulty, and a strong contrast filter, such as the Wratten "G" filter, is a great advantage. Many telephoto workers who are troubled by the flatness and fogginess of their negatives would gain much by the use, first, of a satisfactory lens hood cutting off all light not required and, secondly, of a strong contrast filter.

In exceptional cases, a red filter may be used with advantage. Thus, photographs have been made of a high building at a distance of about four miles, in which an ordinary film allowed the mist to obliterate it completely. With panchromatic film and the K2 filter, the building was photographed as the eye saw it, but with the deep "F" filter it was very much plainer, though, of course, the colors in the foreground and intervening distance were overcorrected. It is sometimes stated that a process film is better for rendering distance, but there is no advantage in this where the improved rendering is only to be obtained by eliminating the effect of the mist, as the process film is just as susceptible to the ultra-violet and violet

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Methods of Guidance in Physical Science

T. A. NELSON

Decatur High School (Continued from December Issue) Decatur, Illinois

In orienting the student in the field of chemistry it may be advisable to present the field though a definite unit of work so as to give the student a sufficient background to enable him to form satisfactory judgments. The following is such a unit being presented.

Major Problem:

In what ways can man utilize his knowledge of chemistry?

Minor Problems:

What is chemistry?

What needs are there in one's personal life that can be met by chemistry?

What needs are there in society which can be met by chemistry?

How are these needs met?

What qualifications do men have who meet these needs?

What are the characteristics of their employment?

I. What is chemistry?
   - A. Study of the composition of matter and the ways by which the composition may be changed.
     - 1. Water—purification
     - 2. Air—conditioning
   - B. Study of the identification, seperation, and transformation of matter.
     - 1. Metal industries
     - 2. Petroleum industry
   - C. Study of chemical changes
     - 1. What happens in burning
     - 2. What happens in the tanning of leather

II. What needs are there in one's personal life which can be met by chemistry?
   - A. Keeping in good physical condition
     - 1. Choosing appropriate foods
     - 2. Importance of fresh air
   - B. The selection and care of clothing
     - 1. Properties of different fibers
     - 2. Cleaning of the clothing
   - C. Recreation of the mind
     - 1. Avocation in chemistry
     - 2. Better understanding of our avocation

III. What needs are there in society which can be met by chemistry?
   - A. The manufacture of goods required knowledge of composition
   - B. The maintainance of health and the curing of disease are possible by means of cheimstry
   - C. Many sources of energy are chemical
   - D. A broad intellectual horizon or culture is attained through chemistry

IV. How are these needs met?
   - A. By skilled workers having a general knowledge of chemistry
     - 1. The baker uses heat to bring about chemical changes
     - 2. The physician understands vhemical processes of the human body
     - 3. The gas station attendent knows properties of auto fuels
     - 4. The astronomer interprets what he sees in the light of chemistry
   - B. By specialists in chemistry
     - 1. Analytical chemist
       - a. Checking incoming materials and outgoing products
       - b. Government inspection of goods
     - 2. Physiological chemist
       - a. Composition of body fluids
       - b. Abnormal changes in disease
     - 3. Industrial research chemist
       - a. The devising of better processes
       - b. The nature of the indefinite

V. What qualifications do men have who meet these needs?
   - A. Specialists in fields other than chemistry
     - 1. Personal traits
     - 2. Educational background
   - B. Specialists in chemistry
     - 1. Personal traits
     - 2. Educational background
     - 3. Skills and abilities

VI. What are the characteristics of the employment?
   - A. Demand for workers
   - B. Age of entrance
   - C. Beginning salary
   - D. Opportunities for advancement
   - E. Advantages
   - F. Disadvantages
   - G. Social importance

We in Decatur try to gain information about our new students so that we will more nearly know what to expect from them. We try to present information to the new students at the very first so that they are more nearly aware of what chemistry will be like and to impress upon them the importance of systematic study and keeping abreast of

(Cotinued on page 14)

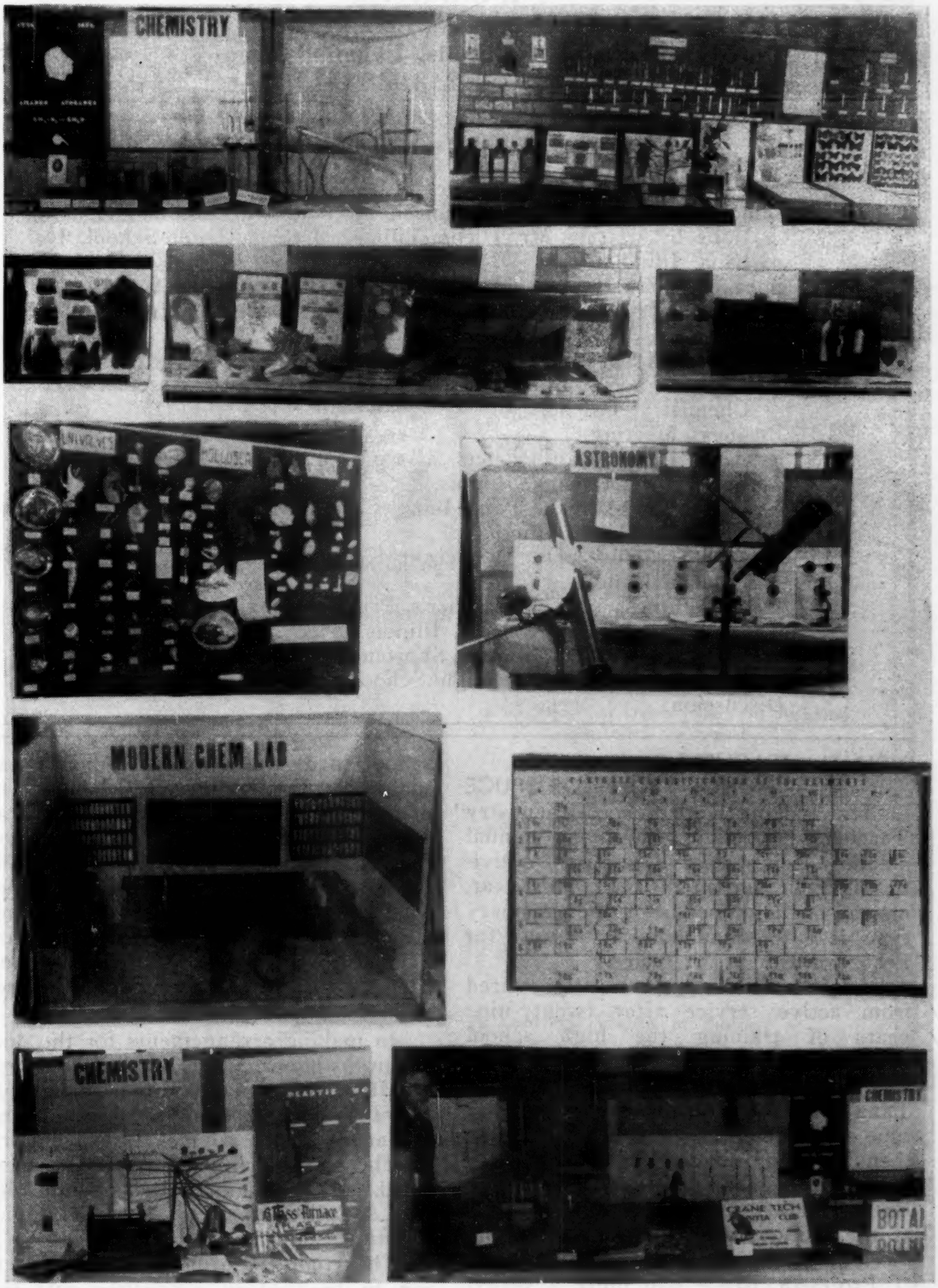


EXHIBIT OF SCIENCE PROJECTS — A few of the many projects exhibited at the meeting of Illinois Junior Academy of Science meeting at Rockford, Illinois, May, 1937.

PROGRAM

ILLINOIS ASSOCIATION OF CHEMISTRY TEACHERS

University of Illinois, Urbana, Illinois

April 2, 1938

10:00-12:00 A. M. Field Trip.
Geological Survey Laboratory, University of Illinois (Group will meet here at 10:00 A. M.)
Soy Bean Research Laboratory.

12:30 Luncheon (Place to be announced on field trip). Make reservations by writing Mr. Glenn Tilbury, Urbana High School, Urbana, Illinois.
Speaker—A representative of the Geological Survey Laboratory.

1:45 Afternoon Program. Room 112, Chemistry Annex, University of Illinois.
Chairman: Professor George C. Ashman, Bradley Polytechnic Institute, Peoria, Illinois, President of the Illinois Association of Chemistry Teachers.
Business Meeting.

1:55 Research in Soybean Proucts, a representative of the Soy Bean Laboratory, Urbana, Illinois.

2:25 New Discoveries in the Paint Industry, Dr. Nicholson, University of Illinois, Urbana, Illinois.

2:55 Atomic Structure, Dr. P. Gerald Kruger, University of Illinois, Urbana, Illinois.

3:25 The Usefulness of Le Chatelier's Principle, Dr. R. M. Parr, University of Illinois, Urbana, Illinois.

3:40 Meeting the Problem of the Shortened Laboratory Period, S. A. Chester, Bloomington High School, Bloomington, Illinois.
Discussion.

INDIANA TEACHERS HONOR PROFESSOR BRUCE

The Indiana High School Chemistry Teachers Association holds an annual meeting each spring. One of the activities is their annual dinner. This year, instead of the dinner being the cusomary type, it is to be an honorary dinner for Professor Edwin M. Bruce.

Professor Bruce has recently retired from active service after twenty-nine years of training the high school chemistry teachers of Indiana. Professor Bruce graduated from the old Indiana State Normal School which at that time only offered two years of work. He then went to Indiana University where he got his Bachelor's Degree in 1899. He did graduate work from time to time at the University of Chicago where he received his Master's Degree in 1916.

Professor Bruce had quite a varied experience in the field of teaching and teacher training. He has taught rural school in Boone County, Indiana; has taught in the grades at Lebanon, Indiana; was superintendent of schools at Hymera and Whitestown, Indiana; taught high school in Princeton, Indiana; was professor of chemistry and physics at Oregon State Normal and later at North Dakota State Normal School. In 1905 he came to the Indiana State Teachers College where he remained until his retirement in 1934.

In making arrangements for the dinner in his honor, Mr. Edward Zetterberg, of Muncie, Indiana, a former student of Mr. Bruce and present president of the Indiana High School Chemistry Teachers Association, is actively interested. Mr. William H Bell of the Coleman & Bell Company of Norwood, Ohio, is acting chairman for the dinner.

The complete program of the meeting to be held in connection with the dinner, together with a list of the

(Continued on page 24)

GUIDANCE IN PHYSICAL SCIENCE

(Cotinued from page 10)

our study from day to day in order to master it with more ease.

We do not have an elaborate system of guidance in Decatur High School. The course a student is following is largely one of his own choosing. The counseling that the pupil receives in making his elections for the next semester comes from his home room advisor. The pupil has a new home room advisor each year and often each semester. Whether the plan of doing the little that we do in chemistry is of much worth is difficult to determine but one cannot help but feel that doing something that is planned would be better than doing nothing at all.

The first step in our guidance plan is to give to each student a questionnaire which is as follows:

QUESTIONNAIRE

Name .... School Year...
What course are you following in high school? ....What other sciences have you had ....
....
How much mathematics have you had?
....
Do you intend to go to college?........
What vocation do you intend to prepare for? ....
Why did you decide to prepare for this vocation? ....
Why did you elect chemistry? ....
....
Have you made the honor roll since coming to high school? ....
Honorable mention? ....

The first few recitation and laboratory periods are given over to attempting to orient the pupil in chemistry and point out to him the part cheimstry plays in preparing him for his chosen vocation. An attempt is made to point out the importance of chemistry to the home, the community, the individual, to particular vocatoons, and to a cultural education. It is necessary that this information be given to the student in brief form because of the extent of the ground covered. This information is presented as unbiased as the teacher can offer it. No attempt is made to sell chemistry to the student or frighten him from the course.

I feel that information of the practical application of chemistry can best be offered at opportune times during the course. All teachers do this more or less. For example, methods of preserving wood and metals from the forces of nature; methods used in purification of water; harmful and beneficial uses of alcohol, the composition of cosmetics and drugs; the rating of different lubricating oils and gasolines; air purification; refrigeration; air conditioning; fire extinguishers; removal of stains from fabrics; etc. can be discussed best from a guidance point of view when the appear in the course from day to day.

In case a student is taking chemistry to fulfill a science requirement or only wishes to acquire an understanding in the course without any intention of studying advanced chemistry, the student can be best guided, perhaps, by occasional attempts throughout the course to make exact tie-ups with the practical and commercial importance of chemistry. Suggested readings along lines of the student's interest or ability will help to broaden the point of view for this type of student.

Guidance of a consumer nature can best be stressed at opportune times during the course when the study indicates definitely something that is familiar to the student. I am of the opinion that this is better than crowding all consumer information into a separate unit of instruction. I feel that the cultural and collateral value of chemistry can be given the student best in the same manner as guidance of consumer nature.

I have included a brief outline of the work that we do in the first topic.

TOPIC I:

How chemistry may be of value to the individual in preparation for earning a living and living a better life.

I. What is chemistry?
  (a) A brief history of chemistry.
  (b) The contribution of chemistry to modern civilization.

(c) The relation of chemistry to other sciences.

II. How may chemistry be of value in earning a living?

(a) Professional preparation.
(1) Doctor
(2) Dentist
(3) Chemical engineer.
(4) Consulting chemist.
(5) Automotive engineer
(6) Pharmacy
(7) Aeronautical engineer
(8) Sanitary engineer
(9) Geologist
(10) Bacteriologist, zoologist, botanist, etc.

(b) Preparation for the so called service man.
(1) Automobile mechanic
(2) Steam fitter
(3) Plumber
(4) Interior decorator
(5) Routine laboratory technician.

III. How may chemistry be of value in living a better life?

(a) Applied chemistry in the home
(b) Sanitary chemistry necessary for the health of a city
(c) Chemistry necessary in understanding simple natural phenomena
(d) Aid of chemistry in consumer education

A second questionnaire is given at the end of the course to discover any changes inchoice of vocation that a student has made.

QUESTIONNAIR II

Name .... School year .... (State frankly). Have you liked your chemistry?......... Have you changed your choice of vocations since last fall? .... Do you think chemistry was difficult for you regardless of the grade you received?................ What, if anything, did you like best in your chemistry course? ....
....

(Continued on page 20)

A Visual Wheatstone Bridge Model

WILLIAM A. HARRIMAN

Mt. Sterling High School — Mt. Sterling, Illinois

As presented at the Illinois State High School Teachers conference by William A. Harriman.

The Wheatstone Bridge, invented by Hunter Christy, was brought into general use by Sir Charles Wheatstone in 1843 in connection with his work with the telegraph. Later he developed a simplified form which was adopted by the British Post and Telegraph Office. Thus it came to be known as the Post Office Bridge.

This type of bridge is found in some high school laboratories; however, the slide type is the most common.

The Wheatstone Bridge has been found to be very difficult for the student to understand. All texts show the bridge as a diamond shape drawing. We teachers sketch this drawing on the blackboard and explain how the bridge is balanced and used. Then, when the student steps into the laboratory, he is confronted by an entirely different-looking piece of apparatus. In endeavoring to span the gap between the drawing and the laboratory apparatus, this visual model has been developed. In it light bulbs are used as resistances, and a clear low watt bulb is used instead of a galvanometer. This bulb may be replaced by a Coltmeter (0 to 60) or by a simple amplifier and loud speaker unit.

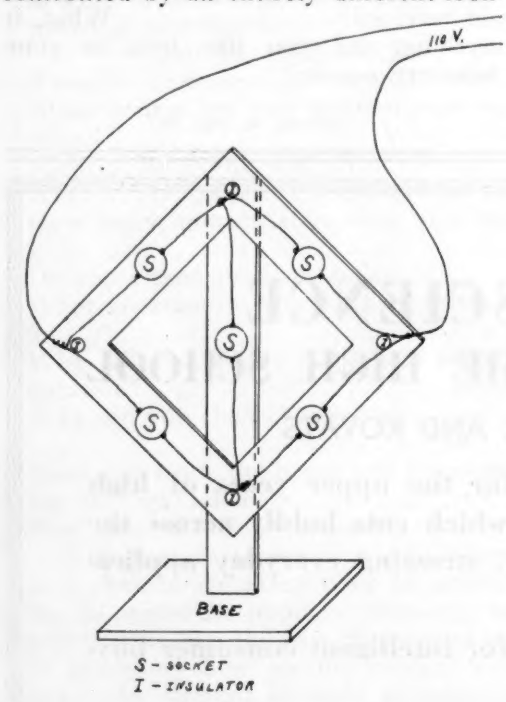
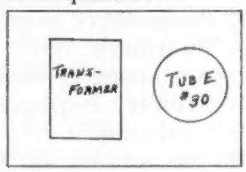


Fig 1

To construct the model the following material is required:



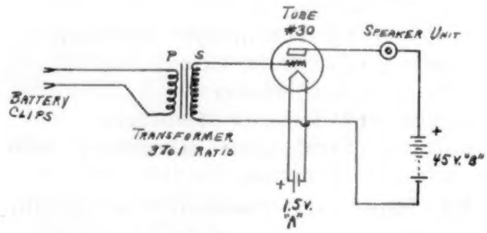


Fig. 2

8 feet White Pine lumber (2 1-2"x3-8").
(7"x10"x3-4") lumber for base.
5 light sockets with wood screws
4 knob insulators with stove bolts
15 feet double twisted lamp cord
1 male plug

At the time of the demonstration the following material is required:

1—200 watt bulb
1—100 watt bulb
1—50 watt bulb
1—25 watt bulb (Marked "x")
1—clear low watt bulb
3 or 4 other sizes all frosted

A square 14 inches on each side is made of the 2 1-2" material. Across this is nailed a diagonal of the same ma-

(Continued on page 19)

TRAINING THE BIOLOGY TEACHER

(Continued from page 3)

invisible unknowns, go to make up in some uninterpretable way these intangible unknown things we choose to say are alive.

The Nature-study teacher in the grades has personified their pets, the cat, the dog, the canary. The teacher of higher grades has brought them to appreciate life in the flying bird, the agile squirrel, the submissive cow, the faithful horse, and a world of flowers, herbs, and trees. It is next the duty of the secondary teacher through the knowledge of the laws of physics, understanding the nature of ions, atoms, and molecules, by the use of the lens, microscope and other equipment to give them that deep look into a drop of water where moves a million units of life within life —then to extend that view to the heavens above, to other planets, to our own sun, to other suns and their planets This long vision from the ion to the infinity of universe upon universe caused many of them to forget their self-centered world and take long thoughts toward that scope of the unknown which has become the fascination focus of the scientific world.

Marsh of Gettysburg College, says in his talk on great teachers: "A truly conscientious teacher can influence and stimulate students with promise and ability, leading those students to give their best efforts to the solution of many problems. The most satisfying reward any teacher can receive from his work is the success of the younger students who come under his advice and direction, for this is the greatest fruit of teaching".

If we can come to the place that we recognize that teaching is the natural thing, that it is mind in contact with mind in the presence of Nature, then and only then have we really begun to teach.

Hear what Longfellow says of the great naturalist and teacher, Louis Agassiz:

"And Nature, the old nurse took
The child upon her knee
Saying, 'Here is a story-book
The Father has written for thee.

" 'Come wander with me,' she said
Into regions yet untrod;
And read what is still unread
In the manuscript of God'.

"And he wandered away and away
With Nature, the dear old nurse,
Who sang to him night and day
The songs of the universe."

To sum up: The training of the Biology teacher requires—

First: The giving of opportunity for a preliminary investigation of industrial, cultural, recreational, social and scientific subjects for orientation of activity toward a definite aim, which is offered by the two years of the junior college course.

Second: Giving the chance to secure knowledge of conditions, attitudes, and activities of the average high school mind toward school society and cultural ideals, by the subjects of psychology, sociology, courses in education, and by actual practice in his chosen field.

Third: Acquisition of knowledge in his chosen and allied fields in senior college work.

Fourth: The development of a suitable technique through actual teaching in the training school.

VISUAL WHEATSTONE BRIDGE

(Continued from page 16)

terial extending 3 inches past one corner and nailed to the base. In the middle of each side and of the diagonal is placed one of the sockets. At each corner is an insulator. The sockets are wired in series parallel, as shown in the figure with the current entering at right and left hand corners. (See Fig. 1).

(Continued on page 24)

PHOTOGRAPHY

(Continued from page 9)

rays scattered by the mist as are other ordinary materials.

Mountain work presents a few special difficulties. Great distances are continually occurring. The atmosphere is very pure, and the chief difficulty consists in retaining correct gradation between the sky and the snow-clad peaks outlined against it.

The light of the sky is due to the numberless dust and water particles suspended in the upper air as well as to the molecules of air themselves. The greater reflecting power of these small particles for violet and ultra-violet light causes the sky color to be blue, and as we ascend higher into the air, the particles decrease in size, and the sky reflection becomes less, so that the color becomes a deep blue, and at very great heights, the sky is nearly black. If, therefore, a deep or even medium filter is used, the sky light may be cut out too completely, and the sky will appear too dark, with the intensely white snow showing in great contrast against it. It is, of course, true that this is to a great extent also the effect to the eye, but an entirely truthful rendering may be displeasing when the charm of the sky color is removed, and the effect is certainly exaggerated if the filter used is of too sharp cut.

The most remarkable results in distance photography are in photography from the air. Captain A. W. Stevens of the United States Army Air Corps has taken a large number of photographs at very great distances. One famous photograph taken in 1931 in South America showing the line of the Andes at a dis tance of 320 miles was noteworthy because the line of haze over the Pampas lying in front of the Andes showed at this distance a very distinct lateral curvature owing to the curvature of the earth's surface.

The reflecting power of objects for the infra-red is often very different from their reflecting power for visible light This is, of course, markedly the case with foliage, and it is also true for dyed fabrics, many of which reflect the infra-red very strongly, so that when photographed they will appear white.

The use of the infra-red for the study of paintings, textiles, and other materials is rapidly being developed.

By means of plates sensitive to the far infra-red it is possible to take photographs in total darkness. This was done on October 7, 1931, when a large group of visitors was photographed in the auditorium of the Kodak Research Laboratory at Rochester. A booth was erected at the side of the room, and in it were placed fifteen one-thousand watt lamps in reflectors pointing towards the ceiling. Over the top of the booth very deep filters (Wratten No. 87) transmitting only invisible infra-red light were placed. Using type I-R plates ad a lens working at f|3.5 a good negative was obtained with an exposure of 1 second. The amount of illumination used was equivalent to about one kilowatt of tungsten lighting per hundred square feet of floor space.

It is a simple matter to photograph a hot body, such as an electric flatiron, in a totally dark room, using the invisible heat rays emitted by the object itself. This has been done, for instance, with a flatiron and an electric soldering iron. The results are interesting in that the variations in temperature over the surface of the object show up as variations in density on the photograph. In the self-photograph of a flatiron, for example, the part of the iron over the heating elements, being somewhat warmer than the rest of the iron, appears lightest in the print. An electric flatiron can be readily photographed by its own heat on Eastman Infra-red Sensitive Plates in a completely dark room.

GUIDANCE IN PHYSICAL SCIENCE

(Continued from page 15)

Did you like or dislike laboratory work? .... Why? State frankly please) .... Do you intend to take more chemistry?......... Why? .... Has this course in your opinion fulfilled your reason for electing it? ....

If the student still has in mind advanced study in a vocation that involves more chemistry and he has done only average work in his high school course, he should be given a personal conference for the purpose of pointing out to him the quality of work required for the vocation that he has chosen. If a student's chosen vocation requires much laboratory work, he should show a marked preference for the laboratory. Otherwise, he should be dissuaded from that particular vocation. If the student has chosen a vocation such as engineering, medicine, etc., it should be impressed upon him, that, in order to complete the work required for engineering or medicine, he must do much hard work that must be of acceptable grade in the university.

As a matter of fact, our students are advised that if they have not done at least C work in high school chemistry, it would not be advisable for them to take more than one course in college chemistry. Students doing A or B work in high school chemistry are encouraged to take more advanced chemistry providing it will aid them in preparing for their future vocations.

Sometimes it may be difficult to point out to a student that judging from the low quality of his work he could not fit himself for the advanced work that he has chosen in the field of physical science. One method that seems to work fairly well on this type of student, is to give him, a college catalogue and ask him to make out a plan of his full college course as required by his chosen field. This is often most revealing to him.

I presume there are other methods of guidance in physical science that are just as good or better. If anyone has any other method of guidance to offer to the committee they will be gladly accepted.

CALENDAR OF MEETING

April 2, Illinois Association of Chemistry Teachers, Urbana, Ill.

April 15, 16, High School Teacher's Chemistry Association of Indiana, Terre Haute, Indiana.

MINIMUM ESSENTIALS FOR BIOLOGY

A Preliminary Committee Report

One of the sub-committees of the Illinois Biology Curriculum Committee is that concerned with the minimum essential topics, subject areas or units for the biology course. This committee makes the following report of progress.

The purpose of this sub-committee is to arrive at a list of subjects that should be included in every course worthy of the name biology that is offered in the high schools of Illinois. It has been the experiences of certain members of this sub-committee that the biology course in our state is an unknown quantity. It is surprising to learn what things are and are not taught in so-called biology courses. Often the teachers through a lack of training honestly do not know what to teach and many would like to have a suggested minimum list of subjects. It is not the idea of the sub-committee to make all biology courses identical or even similar but rather to discover a small list of subjects that can be called essential to a biology course.

No attempt has been made to discover what things are at present included in all biology courses but rather to secure the best judgment of a group of experienced teachers as to what should be the minimum essentials for the biology courses offered in Illinois high schools.

The only premise at the start of the study was that we were considering year courses for sophomores. As the work goes on other limiting factors may be considered. At the start each member of the sub-committee independently prepared lists of subjects that he considered essentials. These lists were combined by the chairman who then prepared the check list used in the study here presented. At the time of the 1937 meeting of the Illinois Biology Teachers Association this list of twenty-five subjects was briefly discussed and teachers were asked to indicate their judgment on the var

MINIMUM ESSENTIALS FOR BIOLOGY

ious subjects presented. As most of us realize, the matter of checking a list and handing it in is often a bore and only those teachers who are sufficiently interested in bettering their profession will cooperate in answering questionnaires

The chairman of the sub-committee feels that the twenty-five teachers who cooperated in this study constitute a majority of the better teachers of the state who attend our meetings. There were in this group teachers from every part of the state and from schools of all sizes. A small percentage were normal school instructors of biology.

Twenty of the twenty-five teachers agreed that the following fifteen subjects should be included in any course worthy of the name biology.

Digestion	Interdependence
Assimilation	Environment
Excretion	Economic importance of plants and animals
Reproduction	
Respiration	
Irritability	Conservation
Photosynthesis	Diseases
Heredity	Food getting
Eugenics	

The ten subjects that six or more of the teachers questioned or ruled out were:

Plant and animal phylla	Evolution
	Health principles
Meaning of life	Fossils
Human structures	Great scientists
Vocational biology	Anatomy of typical forms
Metabolism	

At the end of the check sheet the teachers were asked to suggest other topics if they cared to. Fifteen other topics were suggested each by one teacher. One topic "Student Hobbies" was suggested by four different teachers and doubtless this should be included on any future lists for teachers reactions.

It will be noted that this is a preliminary report. The committee does not feel that the work has been com-

(Continued on page 24)

REPORT OF AMERICAN SCIENCE TEACHERS ASSOCIATION

(Continued from page 7)

lege, St. Cloud, Minn., gave us "The Viewpoint of Colleges That Train Teachers for Rural Schools, Villages, and Towns." Mr. George L. Bush, South Side High School, Cleveland, Ohio, discussed the topic "From the Viewpoint of High Schools Enrolling Many Students Who Do Not Expect to Attend College."

Dr. Otis W. Caldwell, Yonkers, N. Y., Dr. Morris Meister, Supervisor of Junior High Schools of New York City, and Miss Edith R. Force*, Wilson Jr. High School, Tulsa, Okla., presented opinions relating to the topic "From the Viewpoint of the Inter-Relationships of National, State, and Local Science Organizations."

It seems evident that science teachers everywhere are discovering the growing need for a twelve-year science program, and one of the objectives of the American Science Teachers Association will be to promote this objective through a special working committee.

Read by title in absence of Miss Force.

VISUAL WHEATSTONE BRIDGE

(Continued from page 19)

Material for amplifier, if used, is as follows:

1—No. 30 tube with socket
1—3 to 1 audio transformer
'—Loud speaker unit
2—small battery clips
1—45 volt "B" battery
1—1.5 volt "A" battery

Necessary hook up wire and the base board 4"x6".

The transformer and tube are mounted on the base and wired as shown in Fig. 2. The primary of the transformer is hooked across the scket on the diagonal of the model. A loud "A. C." hum is heard when the bridge is unbalanced but no hum when it is in balance.

This model is best demonstrated after a complete discussion of the bridge has been given. It has been found convenient to write the size of the bulbs on the bulb with black paint. To show the unbalanced bridge, bulbs of various sizes are placed in the sockets, but to show the balanced bridge one must use bulbs so they will be in direct proportion in the various branches. All may be the same size, or any number of combinations will do. For example, 30 watt is to 100 watt as 60 watt is to 200 watt. To determine an unknown the lower branch is fixed in a simple ratio such as 100 watt to 200 watt. Then the unknown bulb marked "x" is placed in one of the sockets in the upper branch, and the various sized bulbs are placed in the fourth socket until a balance is obtained. The ratio between "x" and the bulb finally selected is the same as that in the lower branch. Thus the value of "x" is easily obtained.

This model provides a clear and striking visual demonstration of an apparatus and illustration otherwise dif-

MINIMUM ESSENTIALS FOR BIOLOGY

(Continued from page 23)

pleted. They expect to continue. The next steps being to determine the relative importance of the topics by an indication of the relative time to be devoted to each subject and to outline some subheads for the topics. Before this further work is attempted the committee would like to be sure that we have discovered the list of topics that are essential to a biology course. With this in mind the committee invites ideas and suggestions.

INDIANA TEACHERS HONOR PROFESSOR BRUCE

(Contnued from page 12)

speakers, will be published in a later issue; however, any of Professor Bruce's former associates or students who would like any information or have any suggestions may get in contact with one of the above men.

The dinner will be held at Parson's Hall (the new men's dormitory) of the Indiana State Teachers College, Terre Haute, Indiana, on the evening of Friday, April 15.

P. D. Wilkinson,
Professor of chemistry, Indiana State Teachers College, Terre Haute, Indiana.